

TABLE 4.—Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during October 1937

[Wind from N=360°, E=90°, etc.]

Altitude (m) m. s. l.	Albuquerque, N. Mex. (1,554 m)		Atlanta, Ga. (309 m)		Billings, Mont. (1,088 m)		Boston, Mass. (15 m)		Cheyenne, Wyo. (1,873 m)		Chicago, Ill. (192 m)		Cincinnati, Ohio (153 m)		Detroit, Mich. (294 m)		Fargo, N. Dak. (283 m)		Houston, Tex. (21 m)		Key West, Fla. (11 m)		Medford, Oreg. (110 m)		Nashville, Tenn. (194 m)		
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	
Surface.....	°	11	1.5	335	1.0	268	3.0	241	1.8	276	4.1	278	1.3	279	0.1	258	2.0	294	0.8	27	1.2	78	1.8	128	0.5	257	0.9
500.....				323	2.1			264	5.1			310	5.0	246	2.1	281	4.1	311	3.5	132	1.5	89	3.9	93	0.1	241	2.1
1,000.....				316	3.8			261	5.3			306	5.6	275	4.0	291	6.9	302	4.7	313	1.6	113	3.0	150	0.9	277	3.8
1,500.....				306	5.0	266	6.6	262	7.4			293	7.0	267	5.8	284	8.0	302	7.2	334	4.4	134	2.3	172	3.4	234	5.0
2,000.....	251	1.0		291	6.0	282	6.5	264	8.2	279	6.3	293	8.1	273	6.8	289	8.8	309	10.0	326	5.2	119	2.5	179	4.1	294	6.9
2,500.....	275	3.4		284	6.7	288	7.5	254	10.0	290	7.4	294	10.5	255	7.2	294	9.6	313	9.5	331	6.1	130	1.6	197	4.3	297	8.4
3,000.....	286	4.8		280	7.4	296	8.4	271	11.5	297	7.3	284	14.0	250	6.7	297	11.2	313	12.5	332	6.7	83	1.3	197	2.9	284	8.8
4,000.....	278	6.9		301	10.2	308	8.1			298	7.9									299	5.1	34	1.4	230	2.4		
5,000.....	310	6.8								276	3.7									280	4.7						

Altitude (m) m. s. l.	Newark, N. J. (14 m)		Oakland, Calif. (8 m)		Oklahoma City, Okla. (302 m)		Omaha, Nebr. (306 m)		Pearl Harbor, Hawaii <sup>1</sup> (68 m)		Pensacola, Fla. <sup>1</sup> (24 m)		St. Louis, Mo. (170 m)		Salt Lake City, Utah (1,294 m)		San Diego, Calif. (15 m)		Sault Ste. Marie, Mich. (198 m)		Seattle, Wash. (14 m)		Spokane, Wash. (603 m)		Washing- ton, D. C. (10 m)										
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity									
Surface.....	304	1.3	150	0.7	160	0.9	2	0.5	°	41	3.5	°	290	1.1	°	145	2.3	°	40	0.9	338	1.4	°	153	1.6	°	125	0.6	°	307	1.2				
500.....	275	4.1	347	0.4	189	2.0	318	1.2				253	2.1	305	3.0			345	2.8	303	2.3	194	3.5			279	3.6			279	3.6				
1,000.....	270	6.3	37	0.7	226	2.3	290	3.7				312	3.6	302	4.4			321	2.4	300	5.1	188	3.6			278	4.9			278	4.9				
1,500.....	273	7.2	160	0.6	277	4.4	295	6.3				300	4.2	295	6.9			294	2.1	299	7.3	296	5.0			246	4.1	258	6.9			274	9.3		
2,000.....	265	7.5	45	0.4	302	6.0	301	8.3				298	5.7	297	8.0	166	3.0	294	2.4	299	7.3	281	9.3			240	4.2	274	9.3			274	9.3		
2,500.....	255	8.3	280	1.4	315	6.6	306	9.3				299	7.0	298	8.8	185	2.2	271	2.6	290	3.5	282	8.5			236	5.8	256	5.1	275	11.3			293	8.8
3,000.....			288	3.5	307	7.1	305	9.9				316	6.7	302	8.1	258	2.7	249	5.3			235	6.7			297	5.8								
4,000.....					266	3.3	296	10.4						255	7.3			288	4.0	286	6.1														
5,000.....														272	5.9			301	8.0																

<sup>1</sup> Navy stations.

TABLE 5.—Maximum free air wind velocities meters per second, for different sections of the United States based on pilot balloon observations during October 1937

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum ve- locity	Direction	Altitude (m) m. s. l.	Date	Station	Maximum ve- locity	Direction	Altitude (m) m. s. l.	Date	Station	Maximum ve- locity	Direction	Altitude (m) m. s. l.	Date	Station
Northeast <sup>1</sup> .....	35.8	WNW	2,410	30	Kylertown	44.8	WNW	3,550	30	Buffalo	29.4	WNW	6,010	9	Boston.
East-Central <sup>2</sup> .....	37.8	WSW	1,150	20	Cincinnati	39.0	SW	4,420	19	Nashville	40.0	SW	5,220	20	Greensboro.
Southeast <sup>3</sup> .....	29.9	WSW	2,500	20	Charleston	33.6	WNW	3,360	24	Atlanta	41.0	W	8,420	23	Tampa.
North-Central <sup>4</sup> .....	32.5	WSW	1,370	19	Detroit	34.0	WNW	3,170	30	Detroit	37.3	NW	9,790	14	Fargo.
Central <sup>5</sup> .....	33.2	SW	1,040	5	Wichita	42.8	NW	4,660	26	Wichita	38.0	WSW	7,060	5	Omaha.
South-Central <sup>6</sup> .....	29.8	N	1,330	18	Amarillo	45.2	NW	4,630	19	Fort Worth	50.0	NW	6,980	19	Abilene.
Northwest <sup>7</sup> .....	38.6	SSW	1,550	27	Portland	36.5	WSW	2,850	28	Spokane	37.1	NNE	11,810	7	Portland.
West-Central <sup>8</sup> .....	23.2	SSW	2,480	14	Modena	40.7	NW	4,920	19	Rock Springs	51.6	SW	8,690	6	Modena.
Southwest <sup>9</sup> .....	25.4	WNW	1,350	20	Havre	40.4	NW	4,390	18	El Paso	48.0	NW	5,420	18	Albuquerque.

<sup>1</sup> Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and Northern Ohio.<sup>2</sup> Delaware, Maryland, Virginia, West Virginia, Southern Ohio, Kentucky, Eastern Tennessee, and North Carolina.<sup>3</sup> South Carolina, Georgia, Florida, and Alabama.<sup>4</sup> Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.<sup>5</sup> Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.<sup>6</sup> Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and Western Tennessee.<sup>7</sup> Montana, Idaho, Washington, and Oregon.<sup>8</sup> Wyoming, Colorado, Utah, Northern Nevada, and Northern California.<sup>9</sup> Southern California, Southern Nevada, Arizona, New Mexico, and extreme West Texas.

## RIVERS AND FLOODS

[River and Flood Division, MERRILL BERNARD in Charge]

By BENNETT SWENSON

During October 1937, a month which is normally quite dry, an unusual number of floods occurred in eastern United States. The precipitation during the month was above normal quite generally east of the Mississippi River, except in the upper Lake region and in the extreme Southeast. A narrow band over which from two to three times

the normal precipitation occurred extended from southeastern Pennsylvania and eastern Maryland southwestward to the mouth of the Mississippi River. Because of low river stages and the dry condition of the ground prior to the rains, the floods were generally not severe.

*Atlantic Slope drainage.*—Light floods occurred in the

Schuylkill and Chenango Rivers from the 23d to 25th as the result of frequent rains during the month followed by generally heavy rains over the watersheds on the 22d and 23d. No damage of consequence was reported.

Precipitation over the Potomac Basin for October was considerably above normal and amounts varied from 6 to 11 inches over the entire basin. Moderately heavy rains occurred on the 19th and 20th and again on the 23d over portions of the basin but the immediate cause of the flood in the Potomac River was the excessive precipitation on the 27th and 28th. The heaviest rains in the latter period occurred principally over the upper portion of the North Branch of the Potomac and over Stony River. The amounts averaged about 4.5 inches over the North Branch above Keyser, W. Va., and from 3 to 4 inches over other portions of the upper Potomac Basin, with lesser amounts over the lower portion of the basin.

The flood was distinctly an "up river" flood, with a sharp crest at Cumberland and below that point there was a decided flattening of the crest. This was expected, since the stages in the Shenandoah River were relatively low and while other tributaries below Hancock, Md., had moderate amounts of water, the maximum water from these streams had reached the Potomac and passed downstream before the crest from upstream had reached that portion of the river.

The crest at Cumberland (25.0 feet) exceeded the highest stage reached there in April 1937 (24.2 feet) but the crest at Washington, D. C., was only 7.7 feet in this flood as compared to 14.2 feet in April 1937. The low stage registered at Washington was further aided by a strong northwest wind and the arrival of the crest at the time of low tide.

No estimate of the amount of damage has been made at this time.

Heavy rains on the 18th to 20th and again on the 27th and 28th over the James River Basin resulted in two floods in the lower James River. The crests were 30.9 feet on the 20th and 21.5 feet on 29th at Columbia, Va., and 18.6 feet on 21st and 22d and 10.3 feet on the 30th at Richmond, Va. No losses of consequence were incurred.

South of the James River Basin moderately heavy floods occurred principally in the Roanoke River in Virginia and North Carolina, the Saluda River in South Carolina, and the Savannah River in South Carolina. Damages in the Roanoke Basin are estimated at \$110,000, which does not include considerable damage to matured corn in the upper tributaries from which definite estimates have not been received. Losses amounting to about \$37,000 were reported from the Saluda River Basin, the greater part of which occurred along Reedy River, a tributary of the Saluda in Greenville County.

**Ohio Basin.**—Heavy rains on the 27th to 29th over the extreme eastern portion of the Ohio Basin resulted in a moderate flood in the Monongahela watershed, resulting in a crest stage of 27.8 feet (2.8 feet above flood stage) on the Ohio at Pittsburgh, Pa. These same rains produced floods, mostly light, in the Little Kanawha and Elk Rivers in West Virginia and in the North Fork of the Holston at Mendota, Va.

Another period of heavy rain over portions of the basin from the 17th to 19th caused light floods in the New River

in Virginia, French Broad River in North Carolina, and the West Fork of the White River in Indiana.

No losses of consequence were reported in the Ohio Basin with the exception of damage to crops in Henderson County in North Carolina, amounting to about \$3,500. Statistics on the flood in the Monongahela River are not available at this time but a report will be made in a later issue of the REVIEW.

Table of Flood Stages During October 1937

[All dates in October unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
	<i>Feet</i>			<i>Feet</i>	
Schuylkill: Reading, Pa.	10	24	25	11.8	24
Tioughnioga: Whitney Point, N. Y.	12	23	25	15.1	24
Chenango: Sherburne, N. Y.	8	27	24	8.9	23
North Branch of Potomac: Cumberland, Md.	17	28	29	25.0	28
Potomac:					
Hancock, Md.	32			31.8	29
Harpers Ferry, W. Va.	18	29	30	21.5	29
Sycamore Island, Md.	10	29	31	15.4	30
Washington, D. C.	8			7.7	30
James:					
Columbia, Va.	10	4	6	12.9	5
		19	25	30.9	20
		27	31	21.5	29
Richmond, Va.	8	20	23	18.6	21-22
		29	30	10.3	30
Dan:					
Danville, Va.	11	5	6	11.7	6
		20	21	19.0	21
Clarksville, Va.	13	21	23	16.5	22
Roanoke:					
Randolph, Va.	21	20	23	29.2	21
		6	9	35.7	8
Weldon, N. C.	31	21	26	45.0	24
		29	30	34.3	30
Williamston, N. C.	10	11	17	11.0	15
		24	(2)	12.9	29
Saluda:					
Pelzer, S. C.	6	18	23	14.0	19
Chappells, S. C.	15	4	5	17.5	5
		20	23	20.9	22
Broad: Blairs, S. C.	14	20	22	21.2	21
Catawba:					
Catawba, N. C.	8	19	21	20.1	20
Catawba, S. C.	11	21	21	12.5	21
Santee:					
Rimini, S. C.	12	1	2	12.5	1
		6	16	13.7	10
		22	(2)	14.0	25, 27
Ferguson, S. C.	12	8	17	12.8	11
		23	(2)	13.6	27
Broad: Carlton, Ga.	15	4	4	15.0	4
		19	20	24.0	19
Savannah:					
Calhoun Falls, S. C.	8	20	20	8.2	20
Clyo, Ga.	13	28	(2)	15.3	30
MISSISSIPPI SYSTEM					
Ohio Basin					
Tygart:					
Elkins, W. Va.	15	28	29	17.0	29
Philippi, W. Va.	20	28	30	26.7	29
Youghiogheny: Connellsville, Pa.	13	28	29	14.4	28
Monongahela:					
Lock No. 15, Houtt, W. Va.	22	28	29	22.7	28
Lock No. 7, Greensboro, Pa.	30	28	30	39.2	29
Lock No. 4, Charleroi, Pa.	30	28	30	35.9	29
Little Kanawha:					
Glenville, W. Va.	23	28	29	28.3	29
Creston, W. Va.	20	28	29	20.7	28
New: Glenlyn, Va.	11	20	20	12.9	20
Elk: Clay, W. Va.	18	28	29	24.6	28
West Fork of White:					
Anderson, Ind.	8	18	25	10.0	20
Elliston, Ind.	18	20	26	19.2	20
Edwardsport, Ind.	12	20	24	15.3	22
North Fork of Holston: Mendota, Va.	8	28	28	9.3	28
French Broad: Asheville, N. C.	6	19	21	7.2	20
Ohio: Pittsburgh, Pa.	25	29	30	27.8	29

<sup>1</sup> Reading furnished by U. S. Geological Survey.

<sup>2</sup> Continued into November.